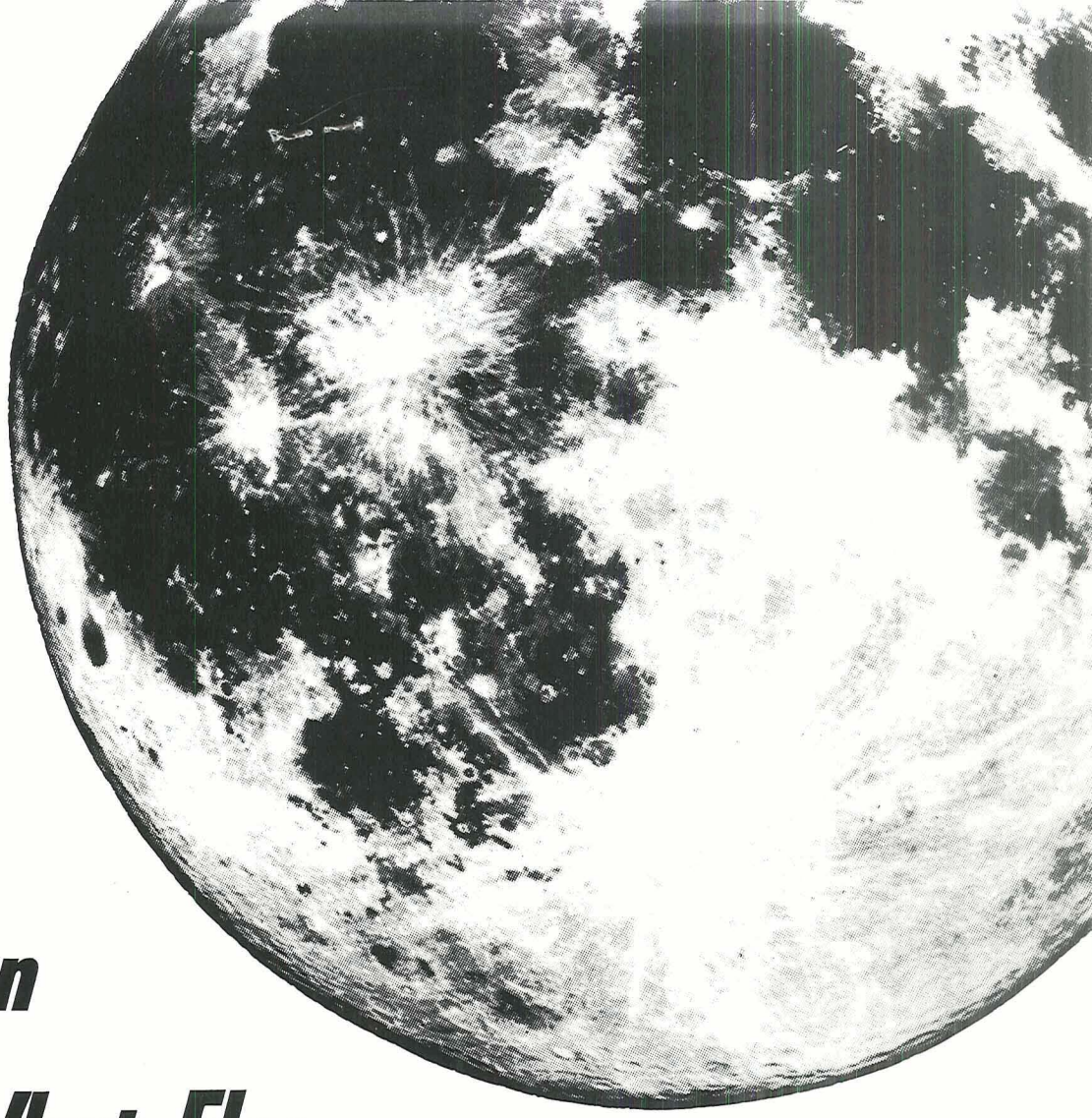

The Moon and What Else for $35 Billion?

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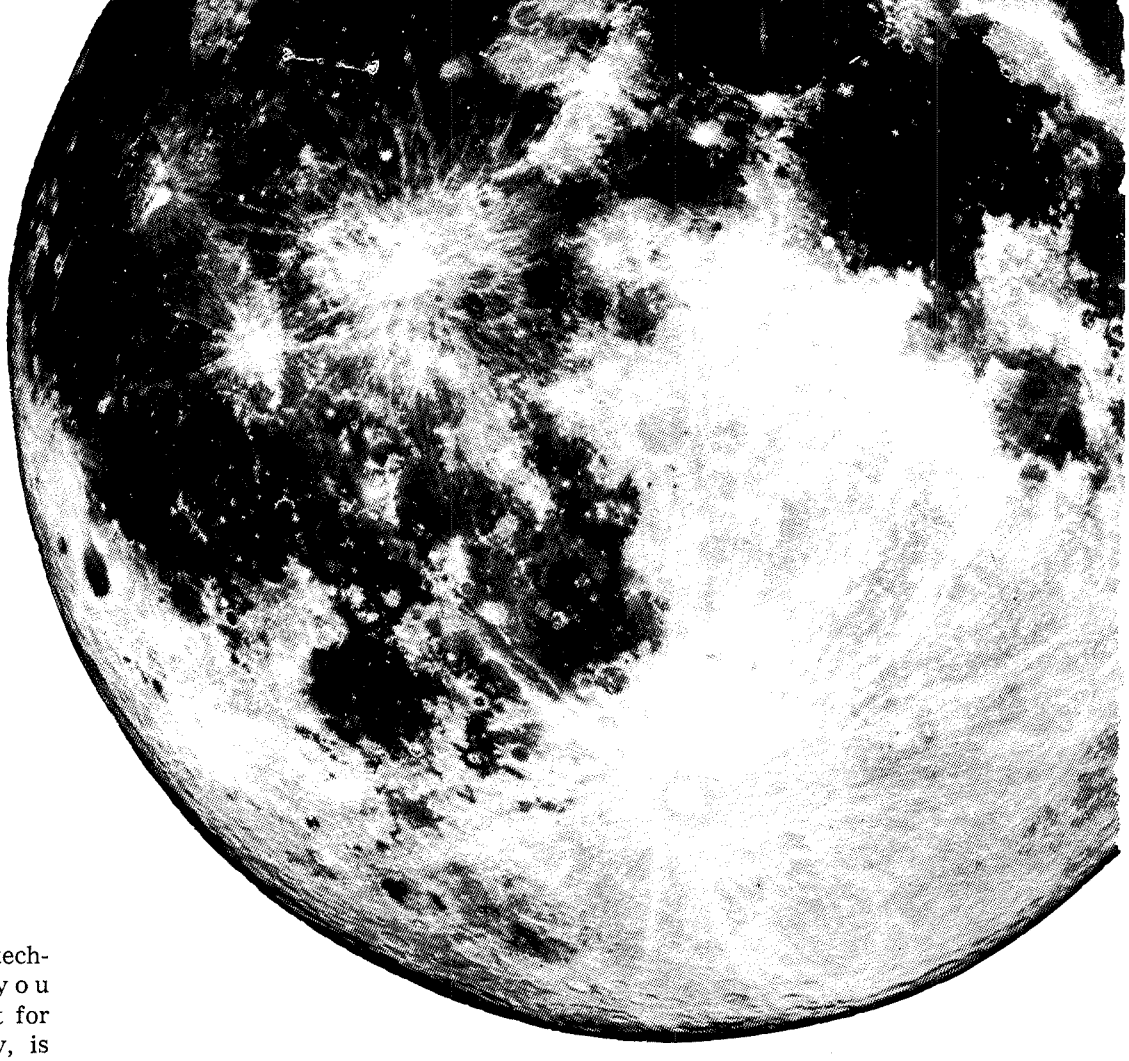
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

DESIGN FOR THE 70S



The Moon and What

ROBERT B. ARONSON
Associate Editor

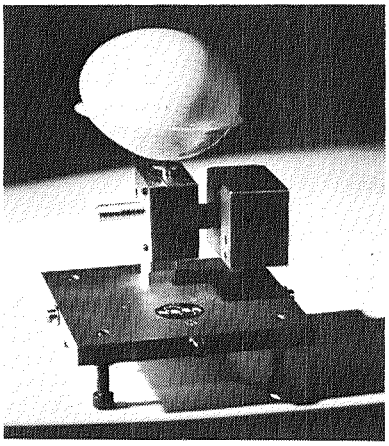
LOOK over this big batch of technical goodies, take what you want, and go make a profit for yourself. This, essentially, is what NASA has been telling U. S. industry for six years through its Technology Utilization (TU) program. While not as dramatic as a moon landing, or as immediately useful as a weather satellite, TU offers a storehouse of potentially useful information for those who are able to dig for it. Through an extensive information dissemination program, TU is trying to increase the return on the $35 billion that NASA programs have used in taxes.

The program to date can probably be termed a partial success. According to most surveys, it is paying its own way. Reports can identify about $3 to 4 million per year in benefits to industry that have taken advantage of NASA information. That is about the cost of keeping the TU program going.

The TU budget for fiscal 1971 is $4 million, which is ⅛ of 1% of NASA's entire budget. Of this figure, $2.1 million are to be used for retrieving, evaluating, and publishing and $1.9 for special dissemination efforts. Congress recently authorized an additional half million to be used to filter out information that might help solve problems in such areas as housing, pollution, and crime.

How Does TU Work?

The long path that gets a useful piece of technical information from a NASA program into the hands of an engineer in industry begins in the laboratories conference rooms and on the drawing boards of NASA's 12 installations and about 4,000 NASA contractors. Information



Sensor developed to detect micrometeoroid impacts has been adapted to detect minute heart tremors in humans.

Comments from Washington

■ Since 1958 the National Aeronautics and Space Administration has been discovering new things about materials, machines, and human beings, as well as the earth, the Moon, and the universe. Mankind's gain would be slight if these many discoveries were not widely shared. From the beginning, therefore, the information and data acquired have been collected and made available to prospective users both within and outside the aerospace community.

The Office of Technology Utilization manages two integrated and complementary information programs using basically the same data base, but which are designed and packaged for two different user groups—one for the aerospace community in direct support of its research and development programs, the other for the public and private sectors in all disciplines for the benefit of man. The first, the scientific and technical information program, involves the vertical transfer of highly technical information to users of the same type as the producers. The second, the technology utilization program, is a specially constructed program to transfer technology horizontally, across disciplines, across regions, across the broad industrial, medical and academic communities.

NASA has pioneered in automating the storage, retrieval, and dissemination of aerospace information and data. This computerized capability in an on-line real-time mode provides services and products to both the aerospace and nonaerospace users. NASA also relies heavily on the conventional methods of communication.

The Scientific and Technical Information Division publishes reports, monographs, studies and reviews of the research and development developed by or for NASA. These are announced and indexed in the Scientific and Technical Aerospace Reports (STAR), and are available to the technical community as printed documents or in the form of microfiche for minimizing cost and storage requirements.

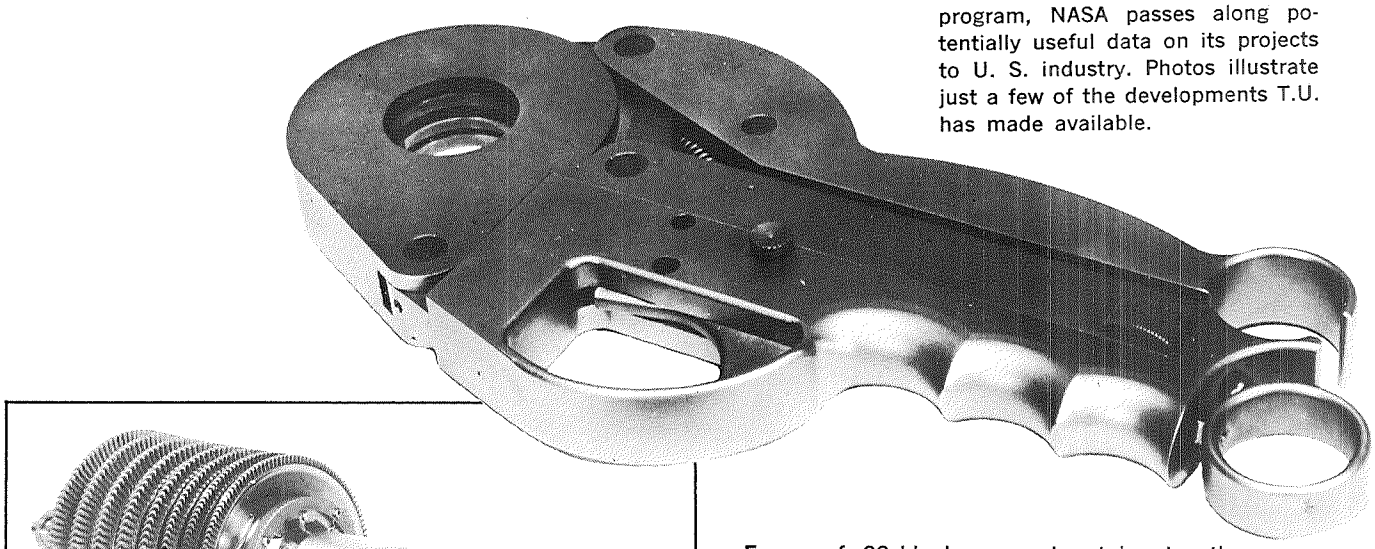
The Technology Utilization Division publishes for the non-aerospace community Tech Briefs, Technology Utilization Surveys, Technology Reports, Technology Handbooks, and Conference Proceedings.

As a research and development agency, NASA's major product is knowledge. By utilizing this new knowledge in nonaerospace efforts, the public gains an additional dividend on its aerospace investment. We are trying to place this new knowledge into the hands of the engineer, the designer, and the manager in a form of the greatest value and in time for it to be of maximum use to him.

Melvin S. Day
Acting Assistant Administrator
for Technology Utilization

Else for $35 Billion?

Through the Technology Utilization program, NASA passes along potentially useful data on its projects to U. S. industry. Photos illustrate just a few of the developments T.U. has made available.



Energy of .22 blank swages two tubes together creating a snug, vibration-resistant joint, above. Turbine rotor, left, is 8-in. long, 7-in. in diam and generates 12,000 hp at 47,800 rpm.

passes both formally and informally from the individual scientists and engineers to one of the NASA installations. Each TU office has a staff that is responsible for gathering and evaluating information in its own area. In addition, each NASA subdivision has someone assigned to look specifically for new technology and pass it along to the TU office. TU staff members also monitor all work reports as well as NASA patents and items submitted to the cost-saving program.

Useful innovations are screened by the local TU staff, then sent to NASA headquarters in Washington, D. C. for dissemination to industry. This is done in several ways.

A brief description of the item may be published as a Tech Brief. Approximately 50 Tech Briefs in nine different categories are mailed to 8,000 individuals each month.

The item may also be a candidate for part of the NASA special series of technical reports, which are compilations of information on a specific subject.

All scientific and technical reports accumulated by NASA are published in STAR (Scientific and Technical Aerospace Report) or IAA (International Aerospace Abstracts). Computer programs are published in CPA (Computer Program Abstracts). These three publications are abstract journals sold on a subscription basis.

Whatever their published form, all documents are abstracted and sent to the six regional dissemination centers. Through computer storage, each center has access to over 750,000 documents with approximately 6,000 added each month. To utilize a center's services, a client pays a service charge for each search made. This might be a single search for information on a specific subject, costing $200, or a series of periodic searches on a certain area of interest, costing up to $5,000 or more.

Realizing that industry can best understand what NASA has available through face-to-face contact, national and regional TU groups hold periodic seminars on topics of interest to a particular industry or section of the economy.

Researchers with specific questions may, under some circumstances, visit various installations and discuss their problems with NASA personnel.

Another effective way of get-

The Word from NASA Headquarters

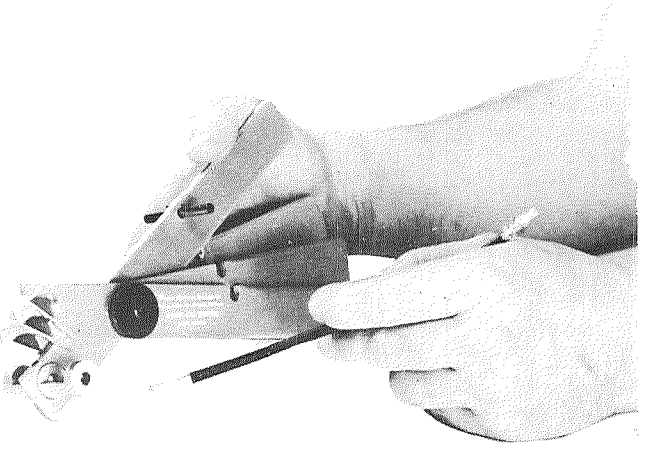
■ NASA has a mandate to provide for the widest practicable dissemination of information for the benefit of mankind. The NASA Technology Utilization Program is specifically attempting to shorten the timegap between the development of new technology and its application to the nonaerospace economy. Experimental programs which may be tapped by those outside of the space program range from announcements of specific, especially promising new technology (NASA Tech Briefs) and special publications such as Technology Utilization Surveys covering NASA contributions to entire areas of technology—to more dynamic problem solving and customer service programs such as NASA Technology Applications Teams and Regional Dissemination Centers.

The technology which results from aerospace activities is often sophisticated, yet it is of such a nature that it can be profitably exploited in the commercial market. To improve our mechanisms for identification of applicable technology and for encouraging its actual application elsewhere, NASA has also established a program to validate reports of actual application and transfer.

More technology already developed in the U. S. space program remains to be similarly applied by those individuals and firms aggressive enough to capitalize on this resource. These include complex electronics, machining and metalworking techniques, computer-aided design and manufacturing processes and much more.

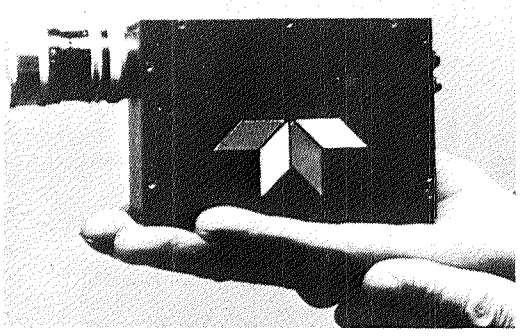
We encourage your participation.

Ronald J. Philips
Director, Technology Utilization Division



Coaxial wire stripper is one of the simpler NASA products to find commercial application.

Miniature TV camera with 1½ in. by 6 in. vidicon tube developed for use in space vehicles is now available for industrial monitoring systems.



ting information transfer on a personal basis is BAT (Biomedical Application Team) and TAT (Technology Application Team). Three BAT's have been functioning for about three years. They are composed of people with engineering and medical training who work with medical researchers and try to solve individual problems with aerospace technology. This personalized attention makes for a clearer understanding of a problem and therefore more chance the answer will be found somewhere in NASA's data.

One TAT which has been around for about one year is taking the same approach to social and urban problems, such as crime, housing, and pollution.

How Good Is It?

The supply of technical information exists as does the demand. The bottleneck is the transfer process. How can the nuggets of generally useful information best be panned from the vast quantity of aerospace related information? NASA would like to know the answer too, and it has instituted a program of self-evaluation. In addition to its own internal monitoring system, NASA has hired Denver Research Institute to do a series of studies on various aspects of the TU program. The Institute's analyses have pointed up a number of problems that have led to improvements.

Unfortunately, a precise evaluation of how well the TU programs are functioning is not possible. DRI researchers found that many companies can not pinpoint where an idea first originated. Many companies are reluctant to admit they are utilizing NASA data for competitive reasons. Or, will not admit they did not think of an idea themselves. In addition, there is little incentive to report sources of information.

What's Wrong With TU?

Critics, informed and otherwise, have listed a number of complaints about the TU program. Possibly valid are these:

It is sometimes not worth the effort to conduct an extensive investigation of NASA data in the hope of finding the useful information.

NASA has not spent enough effort in encouraging those that do the basic research to think in terms of commercial application for their respective projects.

There is a rather long lead time before the data on a NASA project is available to industry. A company picking up a NASA idea therefore runs a risk that their competition already has done work on the subject.

Many NASA projects are "lost in the laboratory" or in a snowstorm of paperwork and never come to the attention of the TU system.

On the business side of the problem, industry is usually not highly motivated to find answers to their problems through a TU program.

There is a reluctance to touch something that is not patent protected. Many NASA items involve ideas that are not patent-

T.U. at Lewis Research

■ The Technology Utilization Office at the NASA Lewis Research Center is representative of NASA Field Center activities in the NASA Technology Utilization Program. We: (1) monitor, for new technology, the research and development work going on both at the Lewis Research Center and under contracts let by Lewis, (2) evaluate the new technology resulting from this R&D work, and (3) disseminate all new technology which has particular potential for applications beyond its original purposes.

To perform these functions, we have a staff of six professional people chosen for their broad and varied experience both in aerospace R&D and in industry, and for their diversity in scientific, technical and business education. Together, they monitor the ongoing R&D of some 2000 scientists, engineers and technicians in-house at the Lewis Research Center, and the R&D being carried out under some 350 contracts between Lewis and approximately 200 industrial firms, private research institutes and universities. In support of our professional Technology Utilization Office Staff, New Technology Representatives are designated by each of the twenty-three Lewis in-house scientific and technical Divisions and also by each of the Lewis technical contractors. These New Technology Representatives assist us by helping to identify new technology developed in their particular areas.

The Lewis Technology Utilization Office is continually exploring additional ways of bringing the existence, availability and usefulness of NASA technology to public attention. We have in the last six years organized and held conferences on selected pertinent technology for the petroleum industry, the electric power industry, small businesses, and a broad audience of industrialists in our own geographic area. We supply appropriate speakers and exhibits for both professional and non-professional meetings. We actively support the publication of articles in professional, technical and trade journals, and contribute to television and radio programs.

Although much of the new technology resulting from Lewis Research Center work is, by nature, most readily applicable to industrial products and processes, the Lewis Technology Utilization Office very actively supports applications of aerospace-related technology to medical and biological research, to public sector problems such as housing and transportation, and to ecological problems. Our evaluation of the new technology being developed here at Lewis considers not only the immediate potential applications, but, very importantly, the broad potential for application to socio-economic problems, in keeping with our responsibility that the national investment in space and aeronautics return the maximum possible benefit to our country.

Paul Foster
Technology Utilization Officer

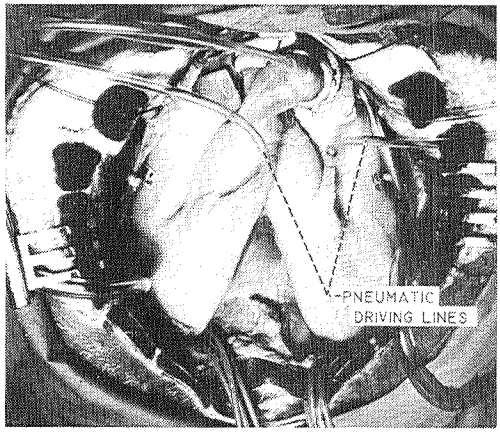
able and, in cases where the item is patented, it is not exclusive for the first two years.

Some smaller companies complain that the library system needed to keep track of TU announcements is beyond their means.

Many industries do not have accurate data on what it costs to retrieve and evaluate data. For this reason, they can not establish the comparative costs of searching for information on their own, hiring an outside firm, or trying one of the TU offerings.

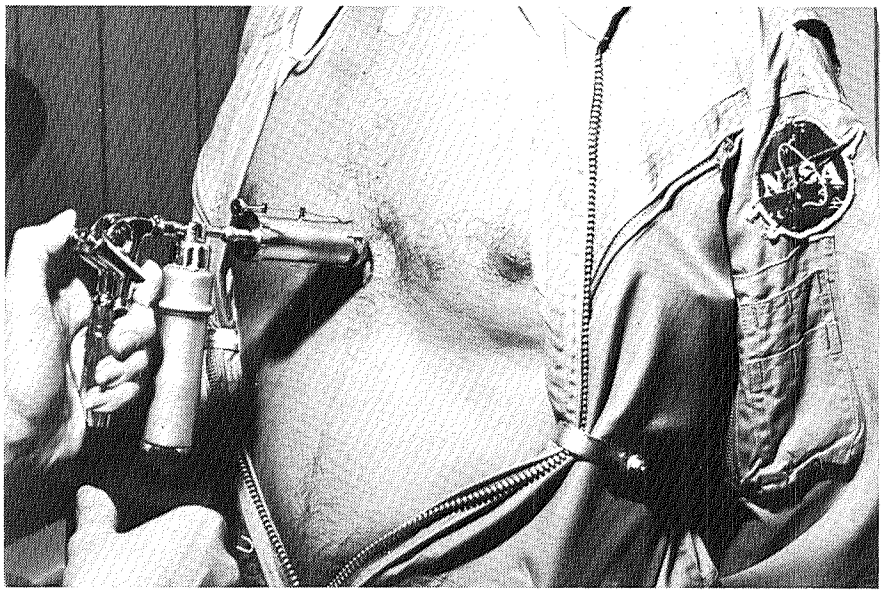
Can It Be Improved?

NASA's TU officials realize that a transfer of documents does not necessarily mean a transfer of information. So, one of the chief research efforts is to analyze in depth the methods by which information is acquired and disseminated by industry. With some knowledge of how this occurs, NASA can then modify its own programs to



Experimental plastic heart, shown here in the chest of a calf, is typical of the many biomedical applications of NASA research.

Spray-on electrode developed to instrument NASA pilots is now used in the study of muscle action.



Used Computer Programs

■ COSMIC—the Computer Software Management and Information Center—helps organizations use knowledge that has resulted from many recent scientific and technical advances.

Founded at The University of Georgia in 1966, COSMIC provides, at reasonable cost, computer programs developed over periods of years by U. S. Government agencies and contractors. Originally, these programs cost millions of taxpayer dollars. Many of these programs can be incorporated into existing commercial or industrial operations with little or no modification. Available on tapes and cards, these programs save organizations money, when properly applied, without adding costly development time.

COSMIC may be thought of as a kind of clearinghouse in which computer software is transferred from government agencies to outside uses and as a transfer point between government agencies.

Before programs can be marketed to solve problems for business, industry, and other consumers, there are several steps through which a computer program must pass prior to receiving COSMIC's stamp of approval.

Evaluation. COSMIC engineers and scientists evaluate a program's documentation first. Evaluators look at documentation from the standpoint of completeness for use by others and rate programs into one of four classes.

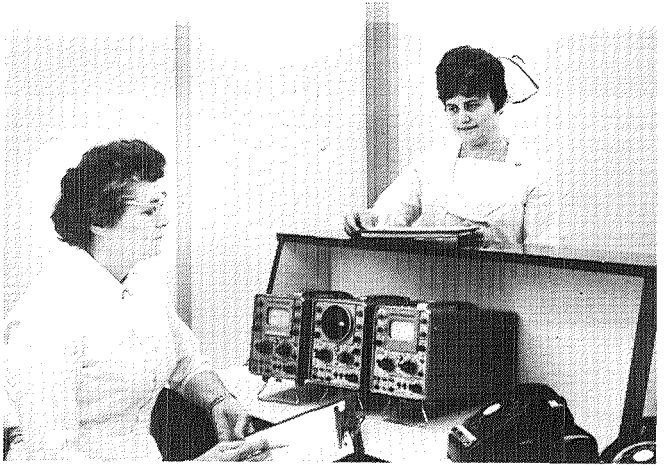
Checking. Programming personnel, well-versed in both documentation and programming, check the packages. Missing cards or subroutines are located, if possible.

Corrections. The same group either tries to correct any found errors or, if too difficult, contacts the program developer for assistance.

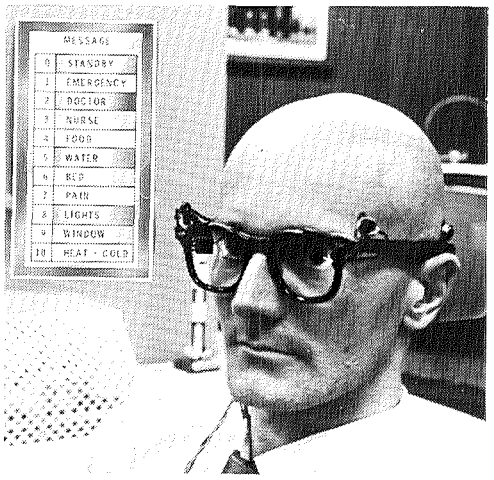
Review. The program analyst and the engineer conduct a final review of each program to decide whether it should be made available for consumer use.

Publicity and Dissemination. The evaluators write abstracts, or short descriptions, on all new programs, including such information as the program's function, language, method, machine requirements, number of program statements, and the program reference number. COSMIC also writes the NASA Tech Briefs, which are descriptions of programs sent to a NASA list of over 10,000 subscribers.

COSMIC also offers other customer services, such as searching for useful programs if a customer can define his needs. If a customer is less definite, COSMIC can send descriptions of programs in the customer's gen-



Instruments developed to monitor the condition of astronauts in space have been adapted to remotely monitor critically-ill hospital patients.



Paralyzed patient sends rudimentary code using on-off switch mounted on his glasses. Operation is based on sensors that detect eye movement.

eral area of interest. COSMIC also will help the customer to implement his programs. Research often is required and performed by COSMIC personnel when customers need help to convert programs from one machine language to another or to adapt a program for a different kind of machine. COSMIC also studies the feasibility of modifications on an individual basis. Sometimes, a program's documentation alone can aid a customer in design and development of his own softwares. COSMIC personnel also check thoroughly updates to prior programs and documentation and advise all users and previous customers of the availability of these updates.

COSMIC publishes a catalog, **Computer Programs Abstracts Journal,** in July with quarterly supplements, that may be ordered directly from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402 at a cost of $2.75 per year.

Those interested in COSMIC's Services can contact the center directly, or any of the six regional NASA dissemination centers, each of which have representatives familiar with what COSMIC has to offer.

Paul Bidell
Associate Director COSMIC

Regional Information

■ Western Research Application Center (WESRAC) is the NASA Technology Utilization Division's dissemination center for the far western states. Located at the University of Southern California, in Los Angeles, and administered by the Graduate School of Business Administration, WESRAC is one of the most recent RDC's established.

Like the other five regional facilities funded by NASA, WESRAC was a part of a program to broaden the use of new technology beyond the technical utilization activities in Washington and to make new technology conveniently available to that vital sector of the private economy which was not in defense or aerospace.

Three years after opening its doors, WESRAC was providing data search services for four hundred firms annually, ranging in size from Lockheed Corp. to the tiny Scientific Drilling Company of Newport, Calif., with less than 20 employees.

The variety and quality of the WESRAC's services are perhaps best expressed by quotes from clients. "We have access to the NASA tapes in Washington," says Horace Jacobs, an official at Lockheed, "but WESRAC's advantage is that they assign a person or two to work with a scientist. There's more personal contact."

A. Kendell Oulie, Director of WESRAC, explains, "What we're selling here at WESRAC is access—the use of computer and search capabilities." He adds, "We're not a grab - bag of treasures for next season's catalog. We can only tell if an idea is applicable, if it can be done within the realm of costs. The idea has to be in the client's head before he comes to us."

Still a different use of the data search facility comes from an official at Dart Industries, another WESRAC client. Here is a case of a large organization using the WESRAC facilities to search out the "state-of-the-art" of a company that Dart might be considering as an acquisition. "When we're probing new business areas for Dart, we need a quick reading to determine if a particular technology has consumer applications," said a member of Dart's technical planning group.

Still a third and different type of user is seen in a most recently acquired client, Pneumetrics, Inc. of Northridge, Calif. This company, seeking to gain a new business in the civilian sector of the economy, saw an opportunity in the development of a conversion kit to convert from gasoline to natural gas. It was a field in which they had no experience, neither in natural gas nor automotive combustion. Nor did they have the time or money to hire consultants to guide them. At WESRAC, Pneumetrics, Inc. was assigned a man holding a doctorate in Chemistry. Working with him, they framed their strategy for scanning the data tapes. The search yielded a collection of hard copy documents from which the new firm was able to complete its pilot model. One NASA document in particular is credited with alerting the firm. Declared Robert Sheldon, an officer of Pneumetrics, Inc., "I don't know what we'd have done without the help of NASA's WESRAC. Their work for us was fast, dead on center and highly reliable. I guess everyone involved in the project would say it was about the best thousand dollars we ever spent."

George H. Corey
Western Research Application Center

make them more effective.

As more large conglomerate industries are formed, the bigger firms will have more extensive information retrieval systems and be better able to afford the TU programs.

By being more careful of what information is offered and by breaking down the information into basic ideas, NASA should be able to make the available data more attractive to industry.

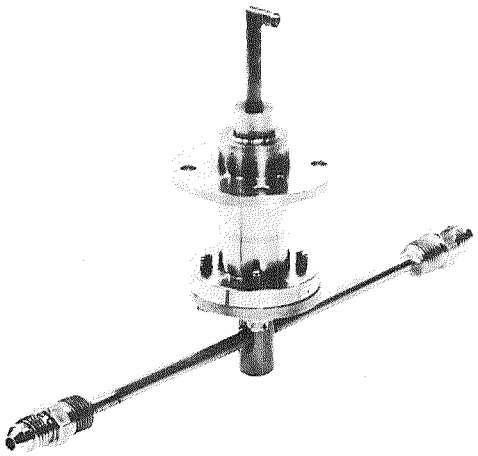
Industry can help by improving its relationship with federal agencies. This will, hopefully, break down the prejudice against TU programs and make industry more aware of potential benefits.

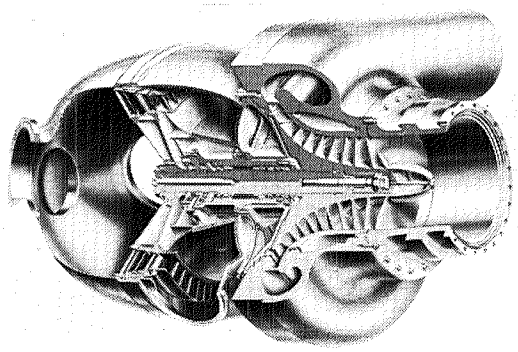
Since the main point of the TU program is the actual transfer of information, it has been suggested that there be more "information brokers." These are individuals, or firms, that specialize in monitoring the information government agencies make available. When they find a potentially useful product or idea, they attempt to market it themselves or sell the developed idea to a company.

Tried TU Lately?

Directors of the TU Program are making an earnest effort to improve the quality of the information they have available and to encourage industry's use of that information. Engineers and managers who have been discouraged in early dealings with TU programs, or who have totally ignored them, might do well to see what is now being offered.

The U. S. Government currently sponsors about two-thirds of all research done in the country. It also has a policy of making all nonclassified information available to industry. As more government agencies join NASA, the AEC, and a few others in systematic information dissemination programs, the government will become the nation's largest storehouse and supplier of technical data. That will be a source that no industry can afford to ignore.





Small transducer, top, measures gas pressure fluctuations of several thousand cycles per sec at temperatures up to 1000 F. Turbopump, above, moves liquid oxygen at a rate of 3,500 lb per sec and a head rise of 1,500 psi.

"Technology Broker's" Opinion

■ When a manufacturer looks for any new product, it costs money, time, and effort. New product searches through NASA will eliminate some of all three.

No plan for product development or improvement has more than a slight chance of success unless backed by a solid statement of objectives and a willingness to do some research. By making this investment, the manufacturer can profit from the NASA Technology Utilization Program. Because NASA has documented its R & D activities, search of their results can eliminate or mitigate the risks and costs of exploration, screening, and, in many cases, prototype and manufacturing technology development. NASA people are frequently able to provide a comprehensive picture of the state-of-the-art, so that the value of prospective projects can be quickly understood. Or, a manufacturer can select an invention, technique, or technology from among those developments already completed by NASA that fits its operation. Once an idea is obtained from NASA's Technology Utilization files, the manufacturer can perform an analysis to determine the potential profitability of the product, technique, or technology. The NASA TU personnel and their university contractors operating the dissemination centers are most cooperative in trying to assist industry. What is fundamental in being able to use this service is to be able to define information sought in terms compatible with NASA's terminology.

Technology Transfer Corporation has had a series of meetings and contacts with NASA TU Program administrators, and every courtesy and facility has been readily available to our personnel. Our company has saved thousands of dollars by employing NASA published information and by talking with NASA personnel. With each successive contact, we learn a little more about what NASA can do for us and what it can do for industry in general. We have learned, for example, that university affiliated dissemination centers can assist with computerized data on specific technological disciplines. We have learned that Technology Utilization Officers are frequently well versed on the commercial possibilities of technologies and products reviewed by them. We have learned that patent counsel personnel are knowledgeable on the technical feasibility and on the proprietary position of products reviewed by them. We have learned that the NASA Technology Utilization Program is not specifically designed for us but for all industry in general, so that we must adjust our searching techniques to their system. We have not expected them to render a "personalized" service, but we have invested some of our time and effort to understand the NASA TU Program. We have received a profitable return on our investment. Based upon our experience, we believe that the industrial community can gain the true benefits from the space age.

E. Allen Stroup
President
Technology Transfer Corp.

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